

# Phase Change Material in New Construction Training Center

August 16, 2017



# Agenda

1. Project Background and Goal
2. M&V and Data Collection Approach
3. Building Energy Simulation and Calibration
4. Conclusion/Recommendations

# Project Background and Goal

Martin Vu

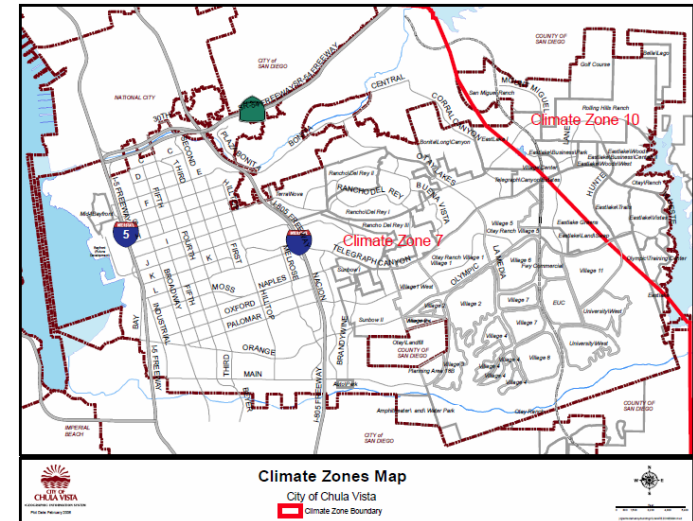


PCM in New Construction Training Center

# New Construction Training Center



- Two story building: 43,874 sq.-ft.
- Located in Chula Vista, CA (CTZ7)
- Opened on October 22, 2015



# Project Background and Goal

- PCM product absorbs and releases heat at pre-defined temperatures.
- Determine the energy savings potential due to the installation of PCM
  - In the stud cavities of the interior/exterior walls
  - Below the roof sheeting



# HVAC System

- HVAC system installed is a Variable Refrigerant Flow (VRF) multi-zone split heat pump system



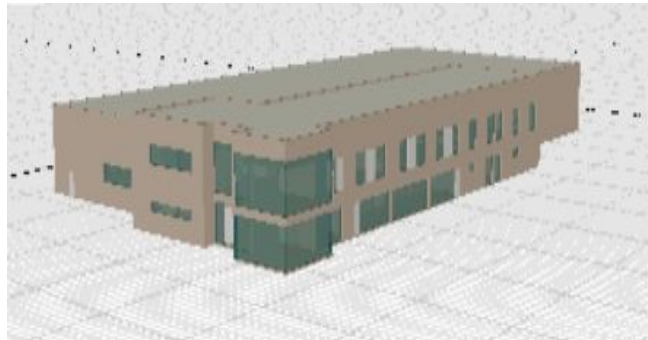
ID	Make	Model	Cooling Capacity (MBH)
1	Mitsubishi	PURY-P96TKMU-A-BS	96
2	Mitsubishi	PURY-P96TKMU-A-BS	96
3	Mitsubishi	PURY-P96TKMU-A-BS	96
4	Mitsubishi	PUHY-P120TKMU-A-BS	120
5	Mitsubishi	PUHY-P120TKMU-A-BS	120
6	Mitsubishi	PURY-P144TKMU-A-BS	144
7	Mitsubishi	PURY-P144TKMU-A-BS	144

# M&V and Data Collection Approach



# M&V Approach

- IPMVP Option D – Calibrated Simulation
  - IPMVP Option D was chosen for the following reasons:
    - This is a new construction project
    - Baseline energy data is unavailable.





# Data Collection Approach

- 12 months of hourly measurement data obtained to determine the HVAC System operating characteristics.
  - Building's Metering System
  - Submetering
    - Supply and Return Air Temperature, Occupancy and Light loggers
- 12 months of billing data obtained for use in the calibration of the whole building.

# M&V Data Collection Points

- Supply Fan Demand (kW)
- Compressor Demand (kW)
- Outside Air Temperature
- Inside Air Temperature
- Building Occupancy



# Building Energy Simulation and Calibration

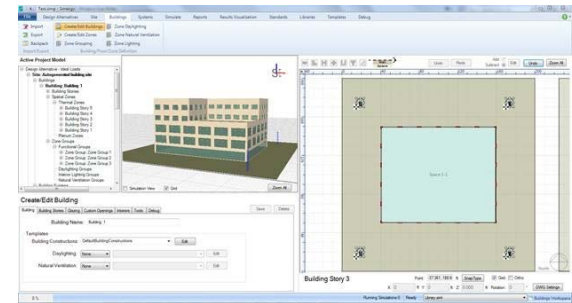
Kyle Dunn, P.E.



PCM in New Construction Training Center

# Simulation Software Tool

- What is Simergy?
  - User-interface for EnergyPlus and is combined with Google Sketch Up
- Why Simergy?
  - Used by SCE in their ET Project
  - EQuest and Energy Pro cannot do PCM
    - Cannot convert EnergyPro into EnergyPlus or Simergy user-interface
  - Tool of choice by default is EnergyPlus
    - (Simergy Interface)



# Building Energy Simulation & Calibration

- Building simulation developed based on current system and calibrated to the data.
  - Whole building calibrated to billing data
    - Billing history = 166,152 kWh
    - EnergyPlus Model = 163,197 kWh
  - HVAC system (heat pump) calibrated to the measured data
    - Submetered Data = 55,717 kWh
    - EnergyPlus HVAC = 56,173 kWh

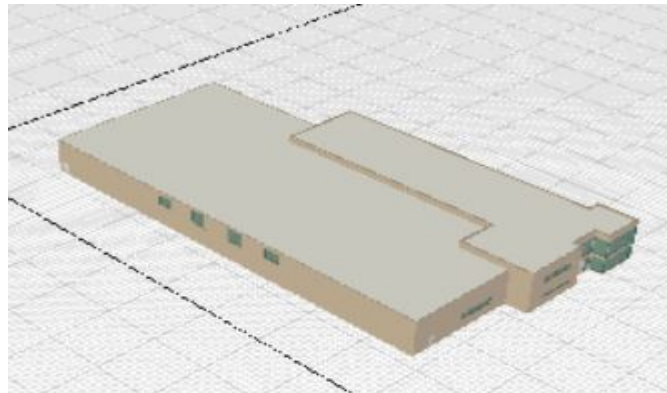
# Building Energy Simulation & Calibration

- Fully calibrated using Conduction Finite Difference Algorithm
  - Re-run model with the PCM material ignored in the roof and/or walls

**Savings = (Simulated Baseline Energy - Reporting Period Energy)**

# HVAC Energy Savings Approach

- Calibrated Post Installation Model Case
  - Scenario 1: Strip all PCM out to get baseline model
  - Scenario 2: Roof
  - Scenario 3: Exterior walls
  - Scenario 4: Interior walls
- Results at HVAC (Heat Pump) ~8-12% kWh savings



# Conclusions/Recommendations





# Conclusion/Recommendations

- For New Construction Projects
  - Use EnergyPlus (Simergy Interface)
    - Use the correct heat transfer algorithm to model PCM (Conduction Finite Difference)
  - Collect enough data to further calibrate the model
    - Billing history
    - HVAC submetered data
  - Estimate Energy Savings Potential by Removing PCM to establish baseline conditions

**Savings = (Simulated Baseline Energy - Reporting Period Energy)**